



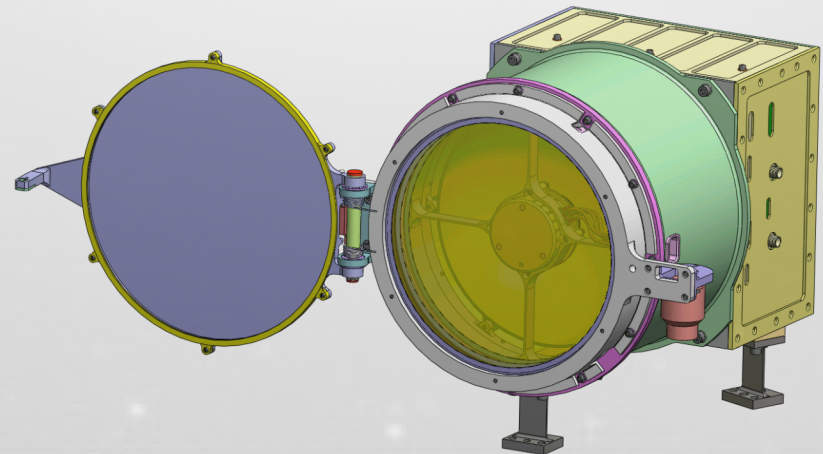
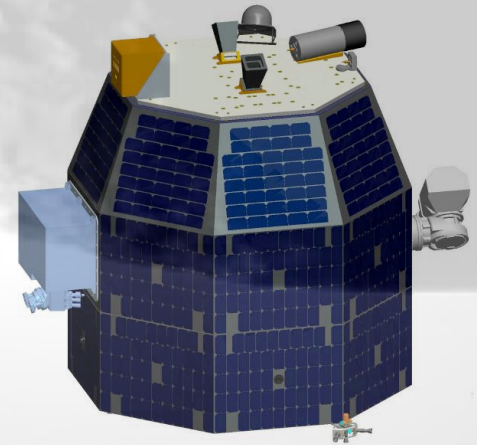
DUST ENVIRONMENT OF THE MOON: EXPECTATIONS FOR LADEE/LDEX



M. Horányi, A. Hasenfratz, Z. Sternovsky, E. Grün
University of Colorado, Boulder

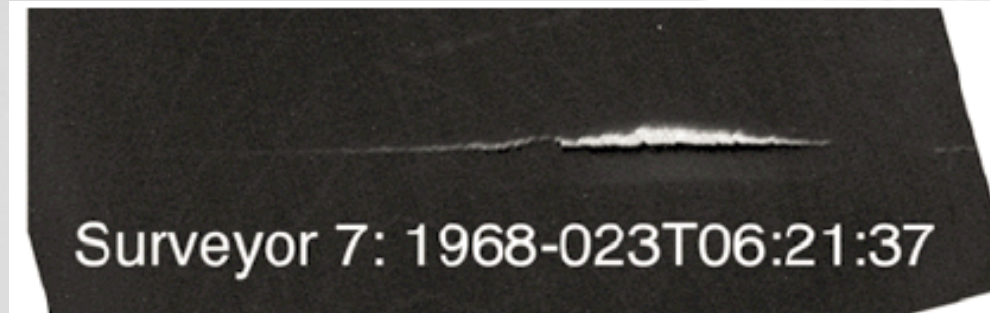
Outline:

- 1) **Sources of dust:**
 - a) interplanetary dust bombardment
 - b) plasma effects
- 2) **Lunar Dust Experiment**
- 3) **Model predictions**
- 4) **Need for surface experiments**

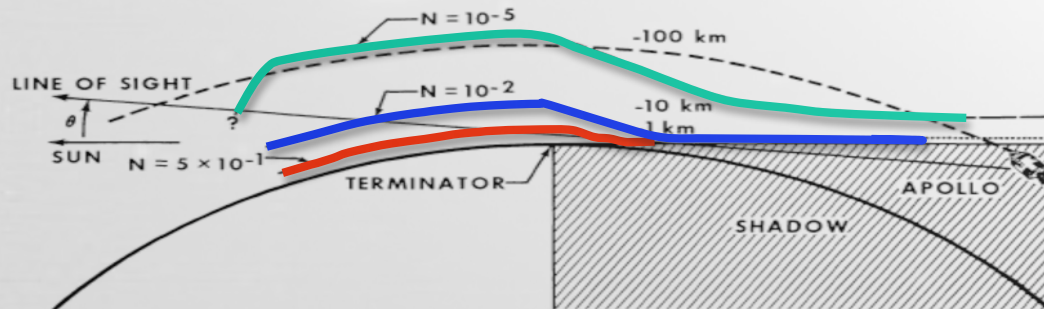




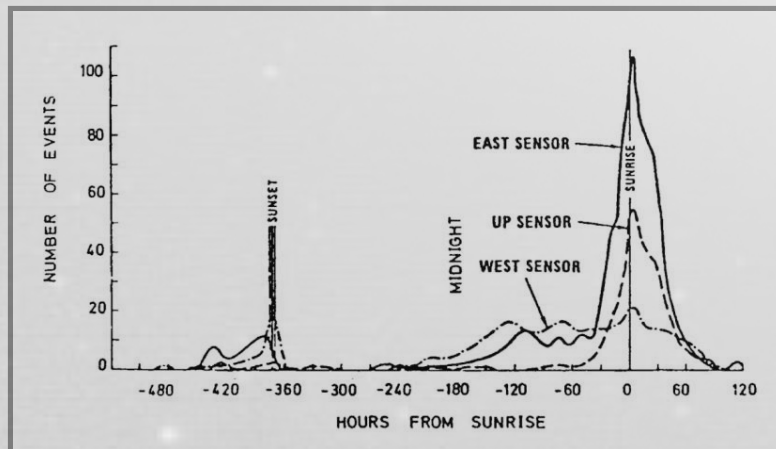
Observations



Horizon glow



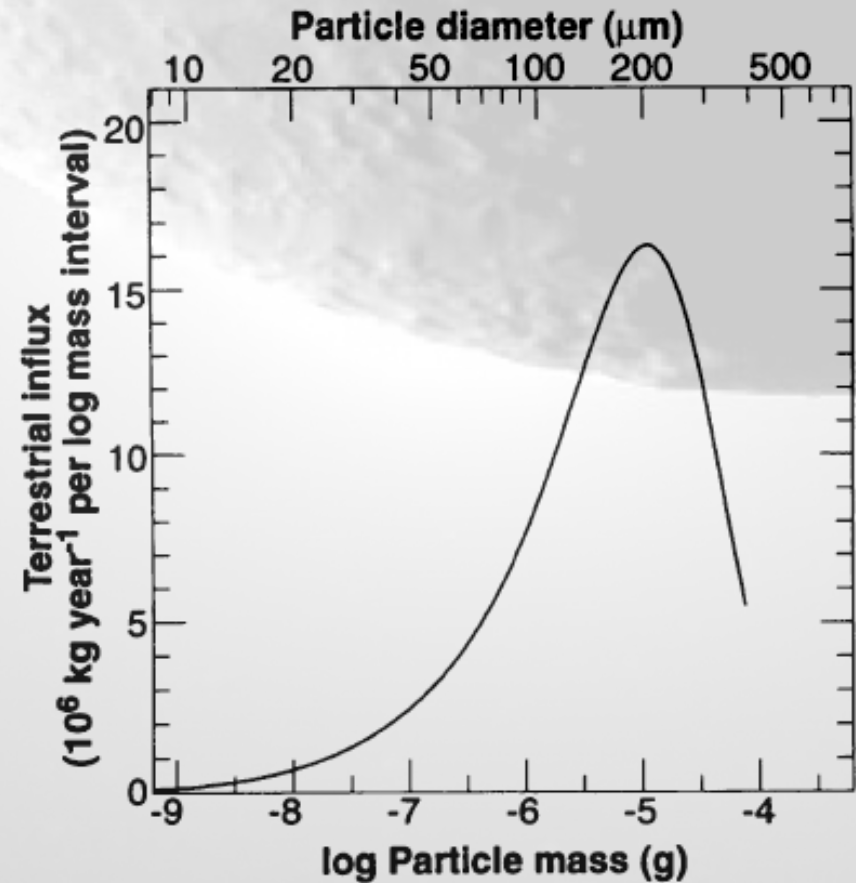
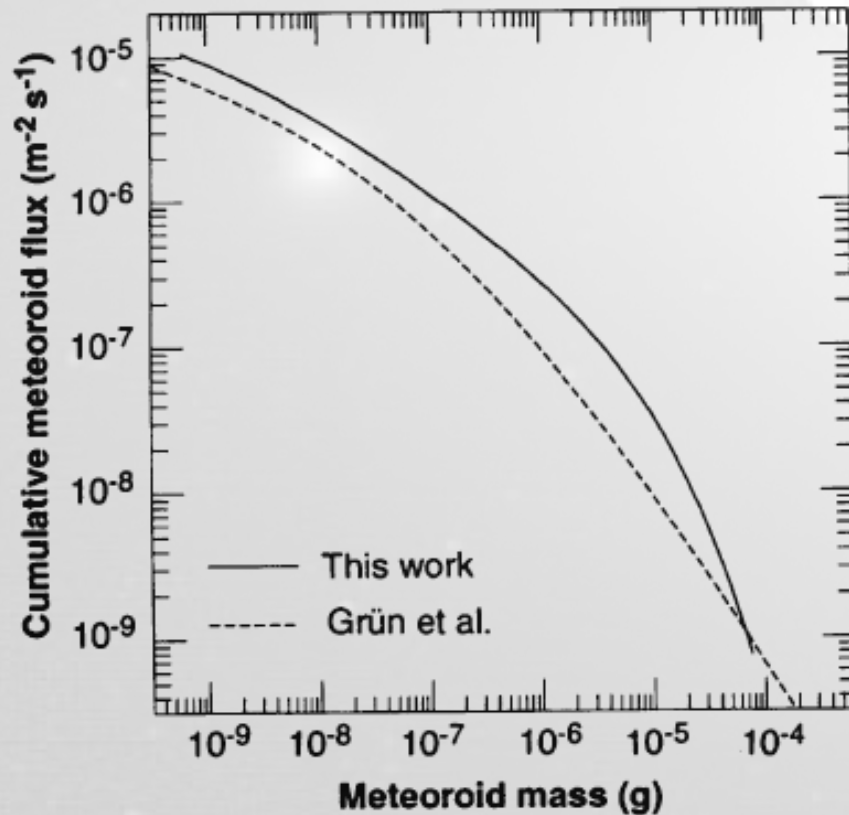
Excess solar brightness



LEAM



Interplanetary Dust Bombardment



100 ton/day @ Earth \rightarrow 5 ton/day @ Moon

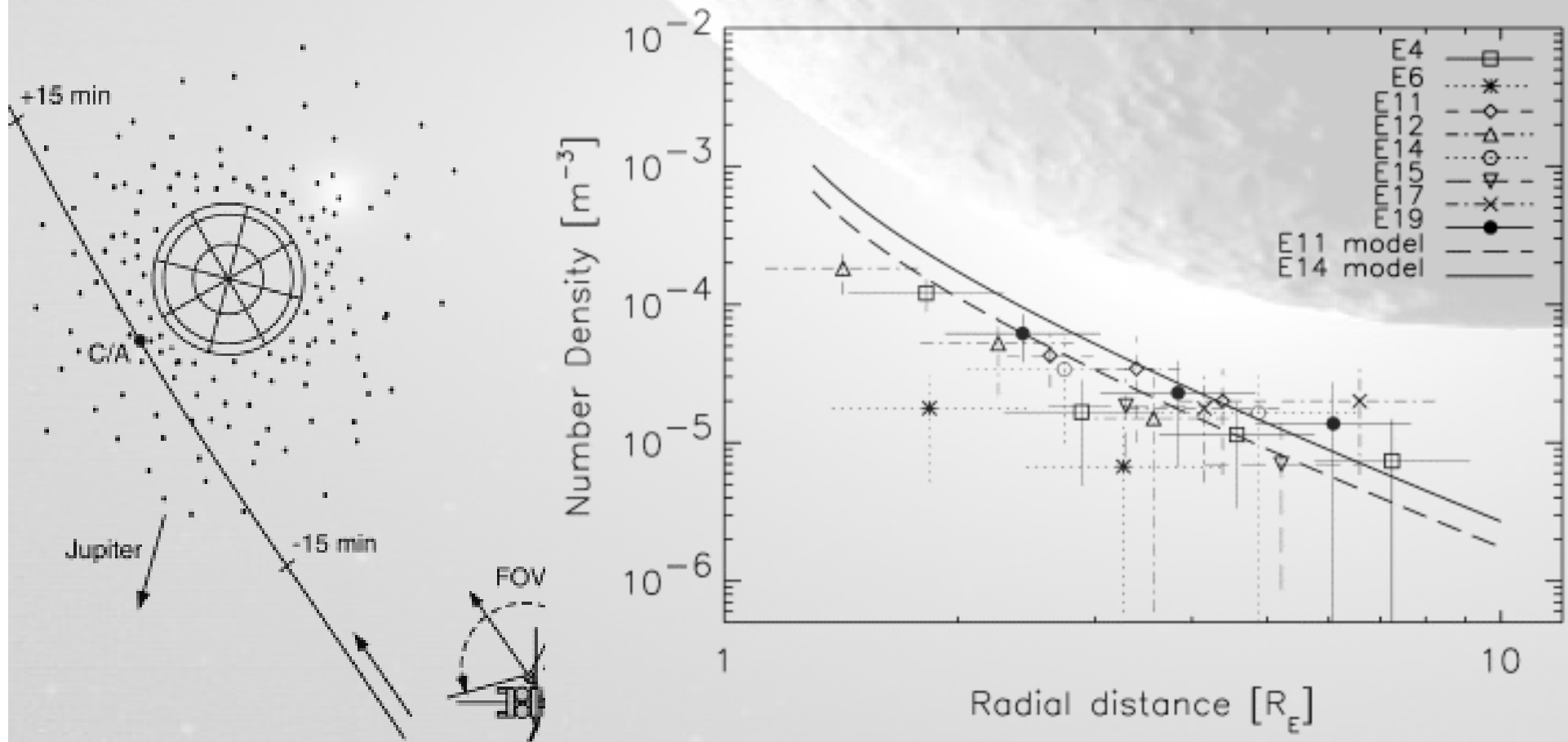
Love and Brownlee, 1993



Secondary Ejecta



Galileo @ Europa



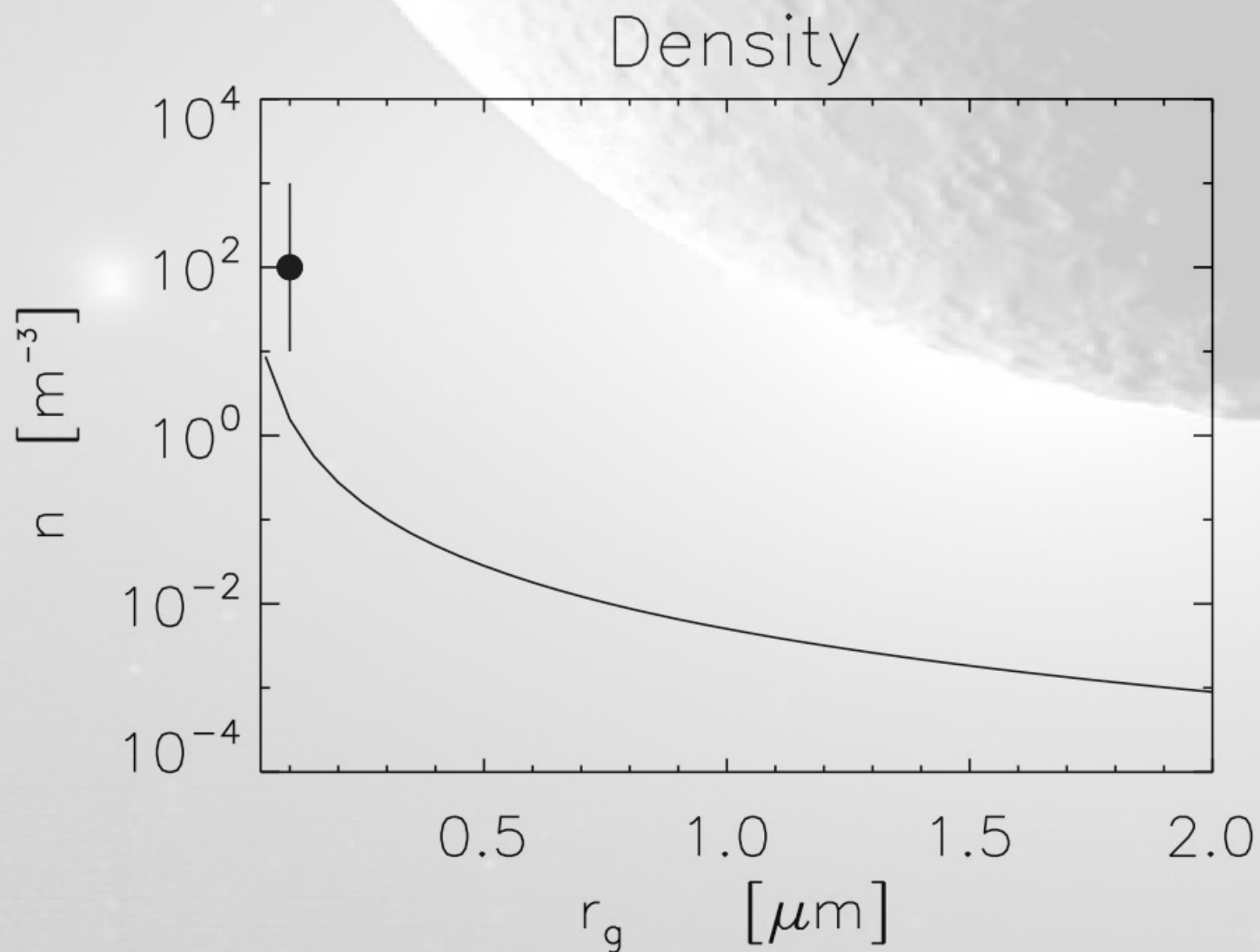
Kruger et al, 2003

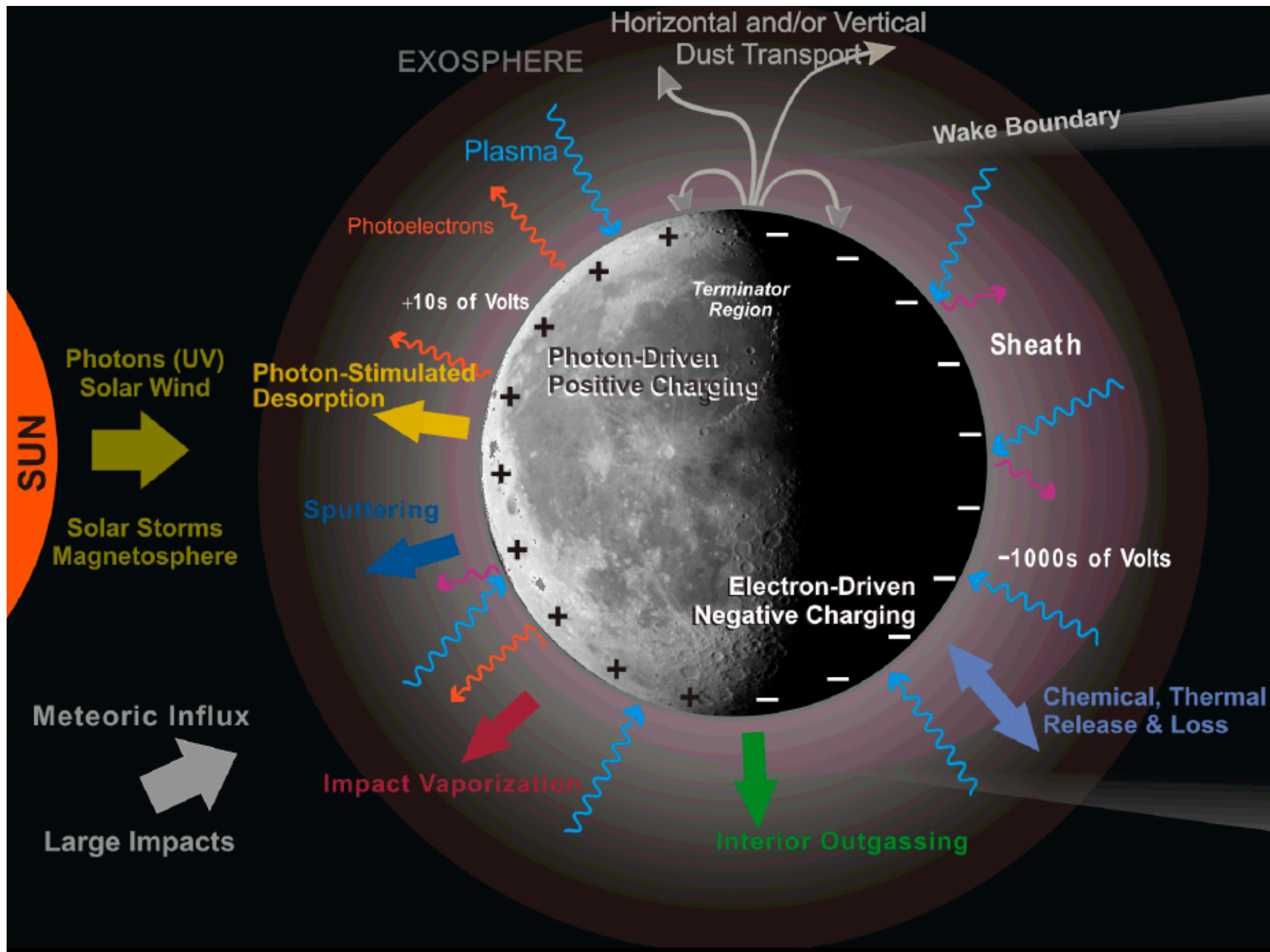
Parameters: yield, ejecta mass and velocity distributions

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Lunar Ejecta







Plasma parameters



SOLAR WIND CONDITIONS

DAYSIDE

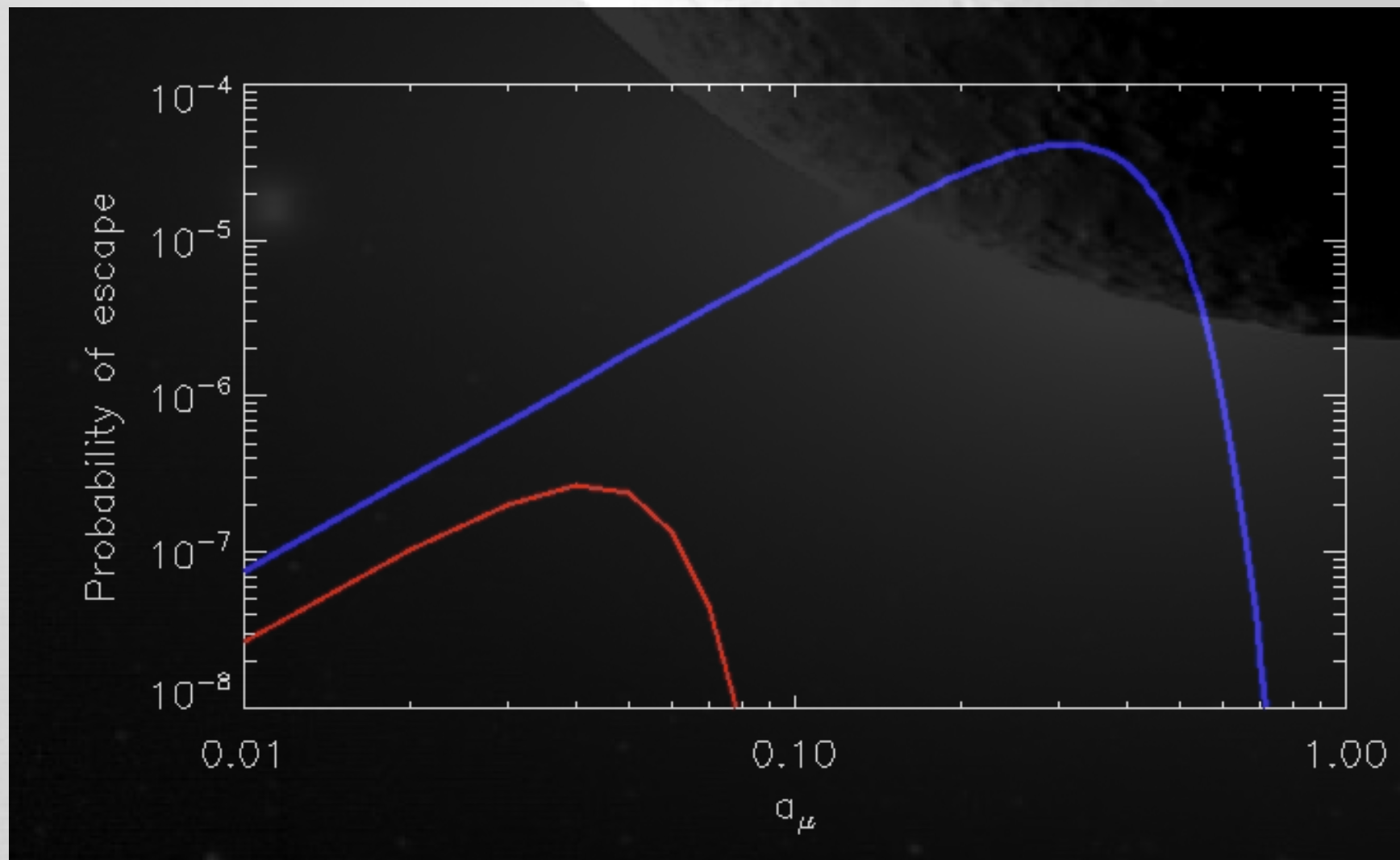
NIGHTSIDE

Photoelectron flux	Γ_0	$\text{cm}^{-2}\text{s}^{-1}$	3×10^9	0
Plasma density	n_p	cm^{-3}	100	0.01
Plasma temperature	T_p	eV	2	10
Debye length	λ_D	m	1	$> 10^3$
Surface potential	Φ_S	V	+5	-1000
Surface charge density	σ_e	cm^{-2}	3×10^4	2×10^3
Surface electric field	E_s	V/m	5	< 1
Probability of 1 e charge	P_e		$10^{-3}a_\mu^2$	$5 \times 10^{-4}a_\mu^2$

Most grains remain uncharged on the surface

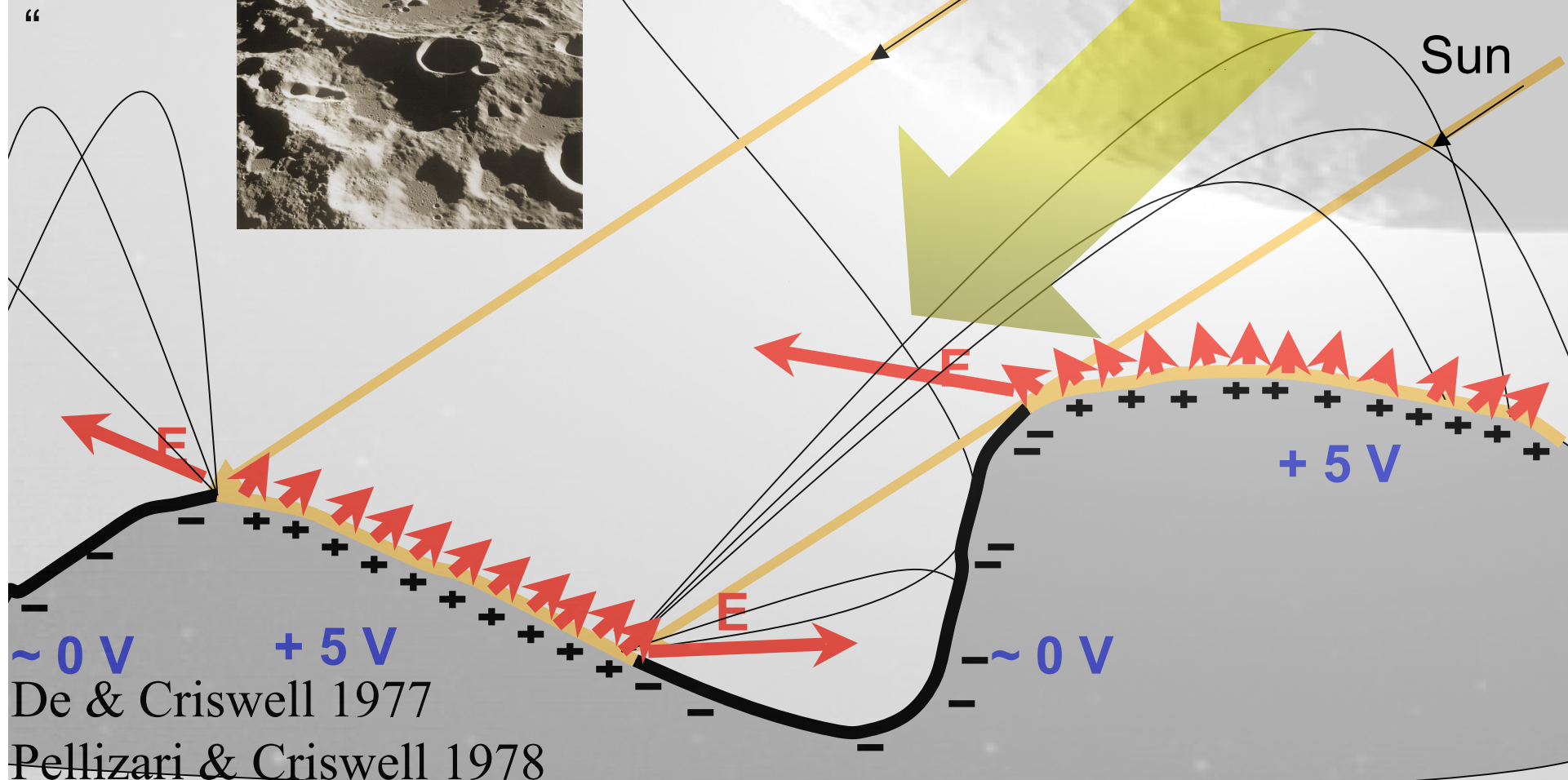
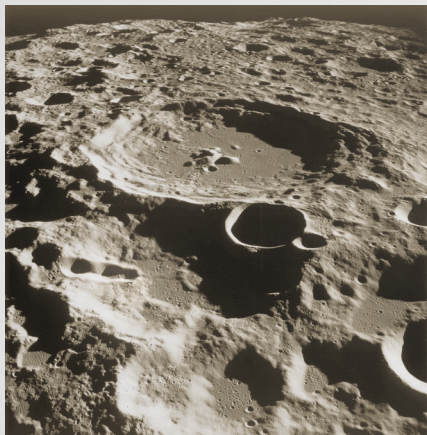
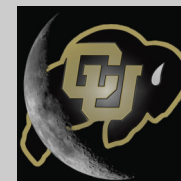


Characteristic grain size





Regions of interest





LDEX Instrument

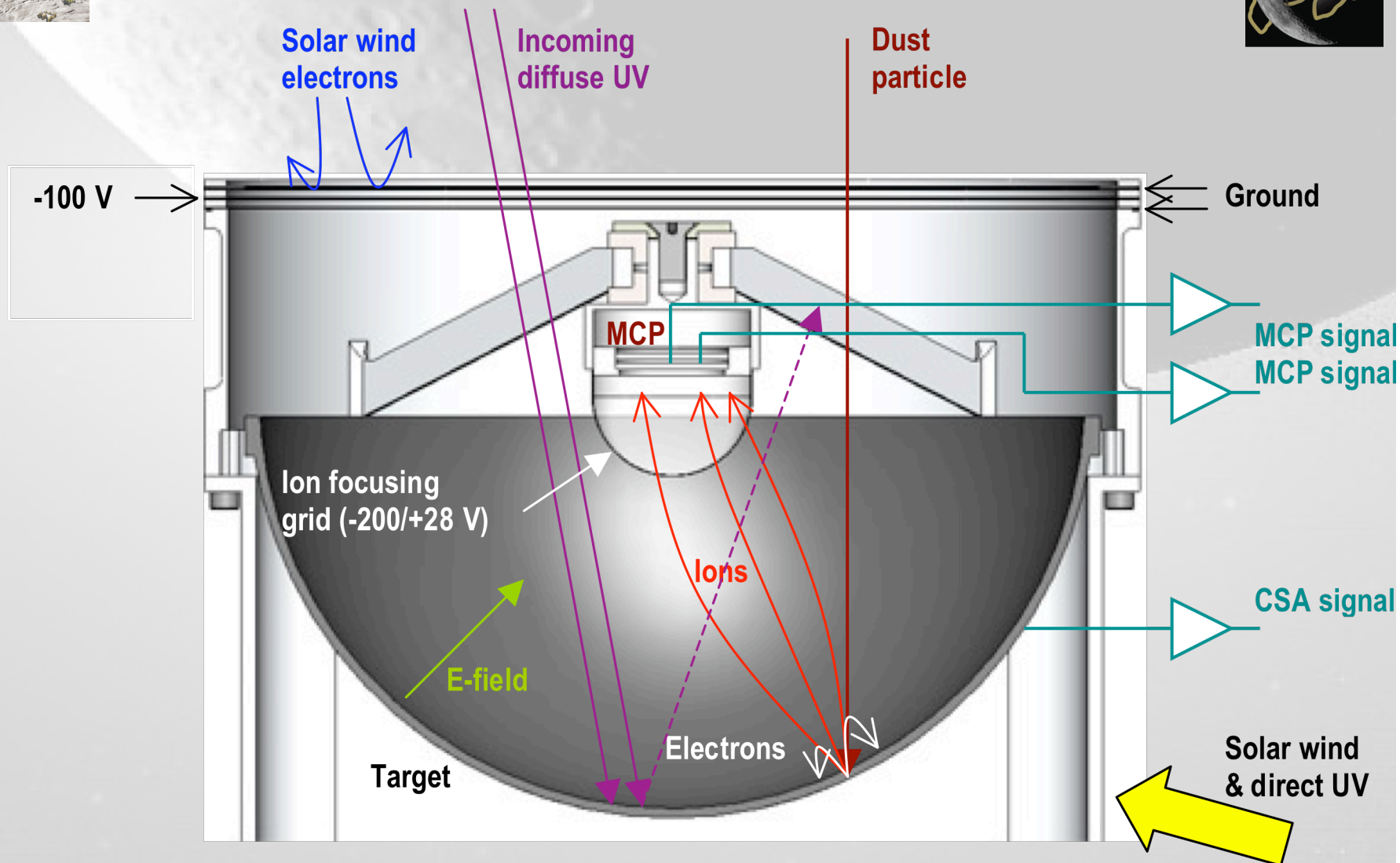
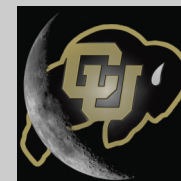
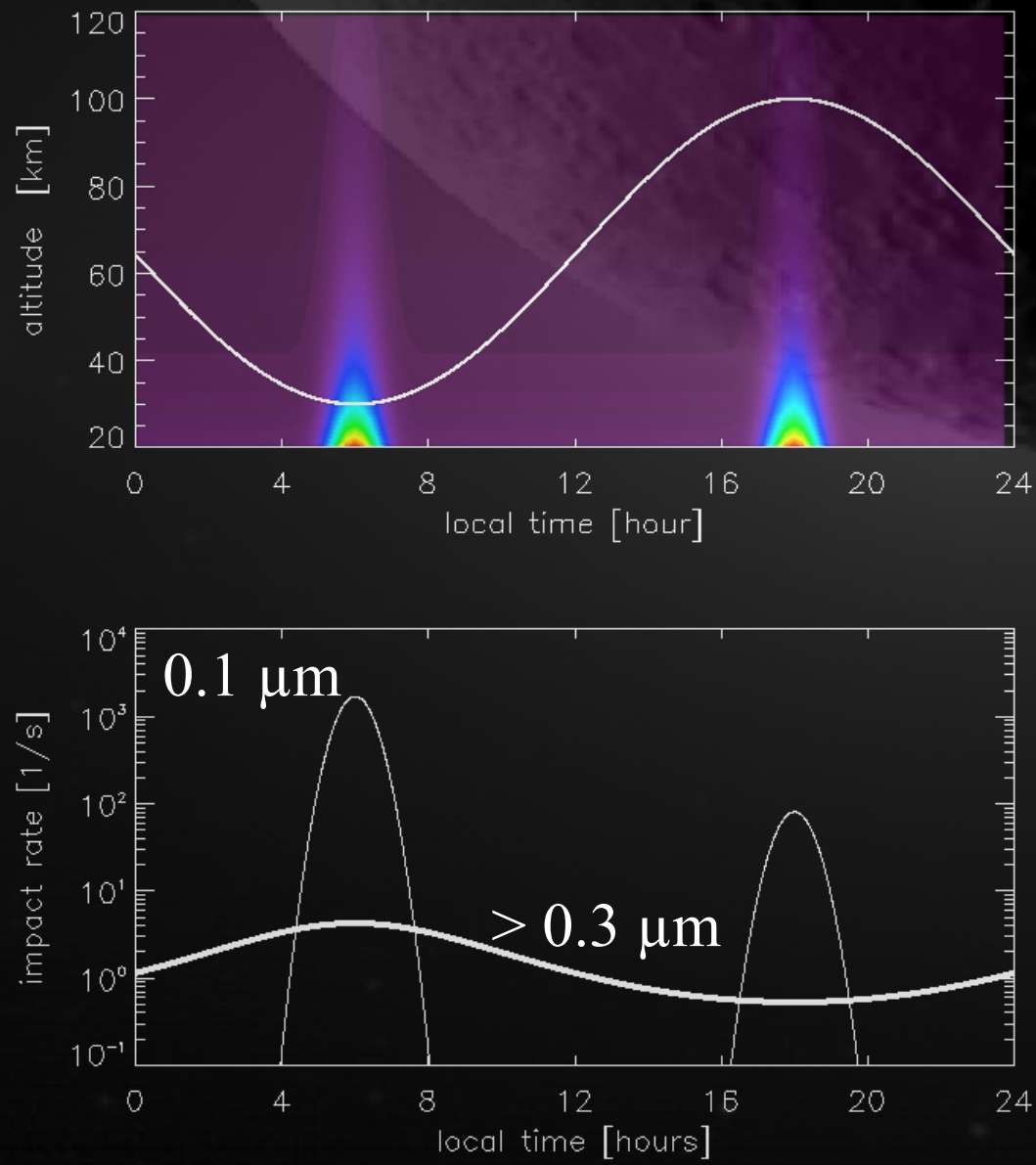


Figure 1.5. *LDEX* schematics.



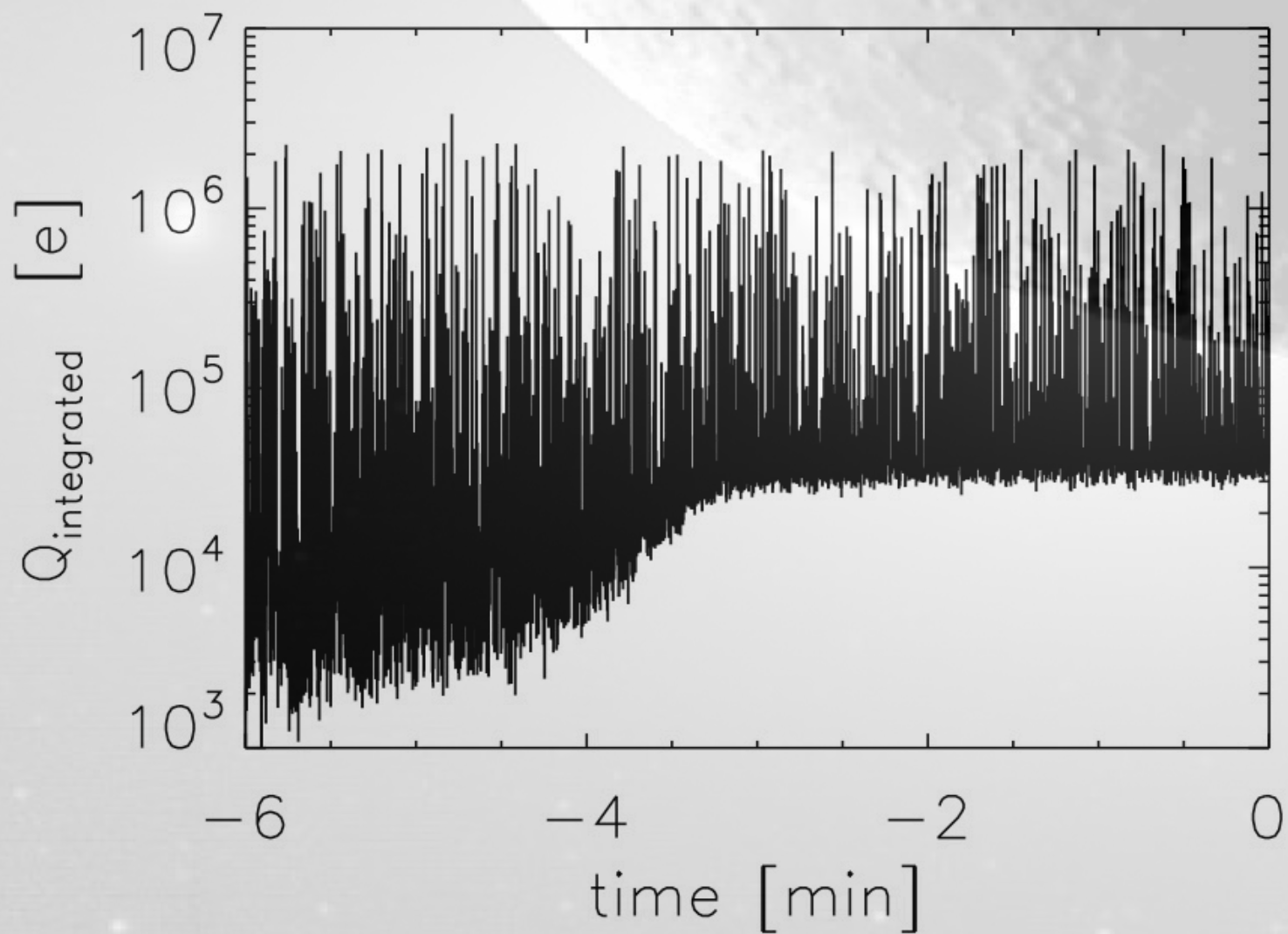
LDEX Impact Rates



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LDEX expectations





Temporal variability



- 1) Spherically symmetric continually present ejecta cloud
- 2) Solar cycle variability of the UV flux (11 years)
- 3) Temporal & spatial variability due to meteor showers on time scales of days
- 4) Density enhancements of small grains over the terminators due to plasma effects, expected to be correlated with solar wind conditions



Summary



LADEE science objective 2: ‘Characterize the lunar exospheric dust environment and measure any spatial and temporal variability and impacts on the lunar atmosphere.’

Surface package to investigate dusty plasma processes:

- 1) stereo imaging
- 2) electron and ion energy distribution
- 3) electric fields
- 4) dust instrumentation to measure: mass, charge, velocity